Reducing Overheating AND Noise

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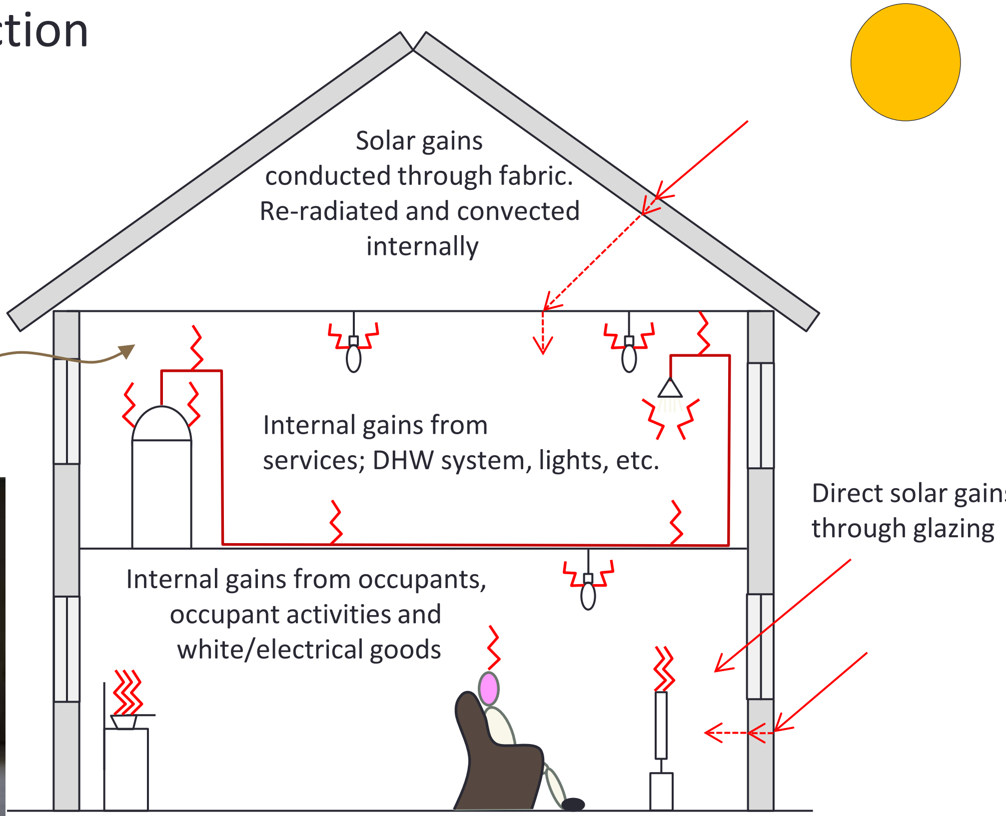
Why do buildings overheat?

- Energy balance
  - Heat in = heat lost
  - Heat in = heat lost + heat rejection
  - Short term – hourly, daily
  - Long term – weekly or longer

Ventilation and infiltration of outside air



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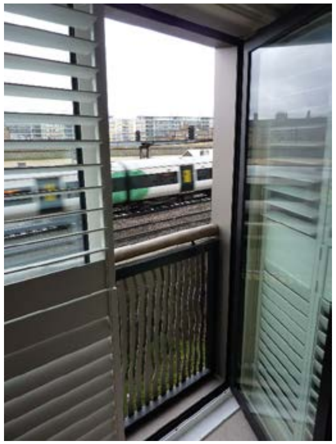


What is overheating?

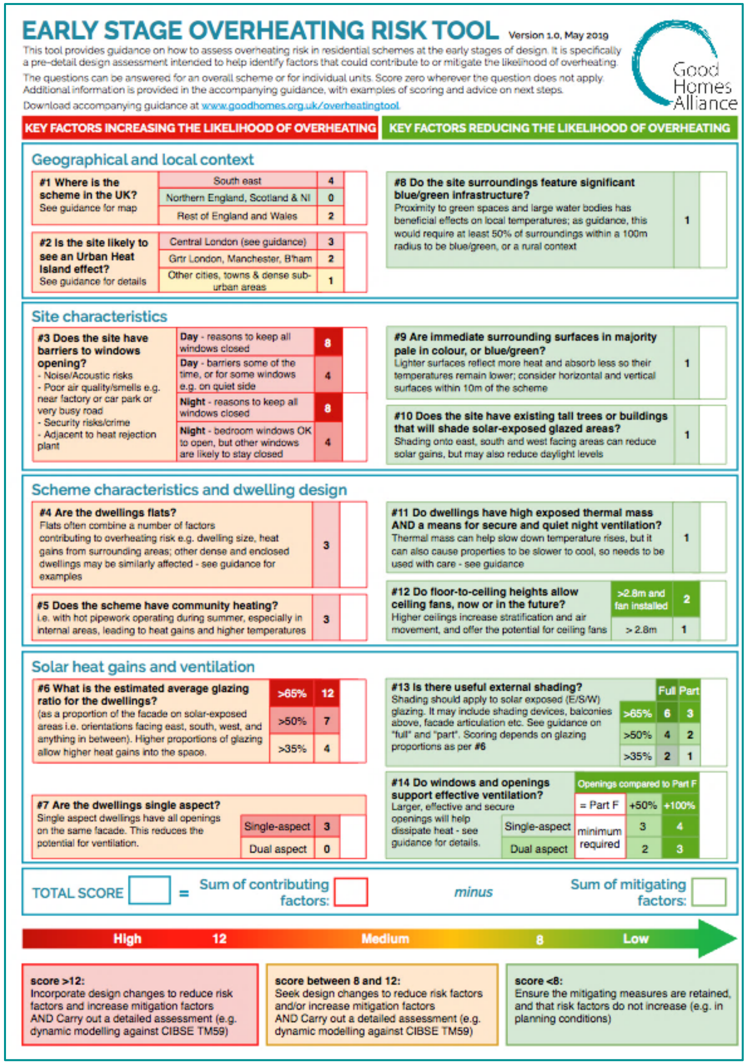
- Thermal comfort or health?
  - Thermal comfort is relatively well defined
  - Heat stress is also relatively well defined
  - Health impacts of long term excess heat are not well defined

- Heat waves or chronic overheating ?

- Sleep – the time the body recovers and rejuvenates.
  - Residents balance the impact of heat against the impact of actions taken to relieve the overheating.

GHA Tool

- Not a spreadsheet!
- One page
- 14 questions split into risk factors and mitigation measures
- Simple scoring
- Recommendations based on scoring
- FREE to download
- Comprehensive guidance notes provided



EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, May 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Download accompanying guidance at www.goodhomes.org.uk/overheatingtool

Good Homes Alliance

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	4
	Northern England, Scotland & NI	0
	Rest of England and Wales	2
#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3
	Grtr London, Manchester, B'ham	2
	Other cities, towns & dense sub-urban areas	1

#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	1

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	8
	Day - barriers some of the time, or for some windows e.g. on quiet side	4
	Night - reasons to keep all windows closed	8
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance		1
#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	2
	> 2.8m	1

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space.	>65%	12
	>50%	7
	>35%	4
#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation.	Single-aspect	3
	Dual aspect	0

		Full	Part
#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6	>65%	6	3
	>50%	4	2
	>35%	2	1

		Openings compared to Part F		
#14 Do windows and openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance for details.		= Part F	+50%	+100%
	Single-aspect	minimum required	3	4
	Dual aspect		2	3

TOTAL SCORE = Sum of contributing factors: *minus* Sum of mitigating factors:

High 12 Medium 8 Low

score >12: Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score between 8 and 12: Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score <8: Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

GHA Tool – accompanying guidance

- Why?
- Scoring
- Mitigation
- References

#8 - Do the site surroundings feature significant blue/green infrastructure?

Why?

At the local level, the presence of blue/green infrastructure such as parks, generous landscaped grounds, rivers, or large water features helps reduce external air temperature.

Small blue and green infrastructure elements aggregate and contribute to local effects, so there is a continuum of effects rather than a clear threshold. For the purpose of this tool, the level of blue/green infrastructure considered to have a
within a 100m radius from the site (note - this is in line w
BRE's Home Quality Mark temperature tool).

This question can be evaluated from local site informat
or other mapping resources if available. Examples are i
authorities may be developing datasets as part of exerc
heat risk mapping; do feel free to contact the GHA if yo
be added to the reference list.

Local authorities who do not currently have green infras
develop one, as this can help with a number of objectiv
such as flood risk mitigation, biodiversity, air quality, and

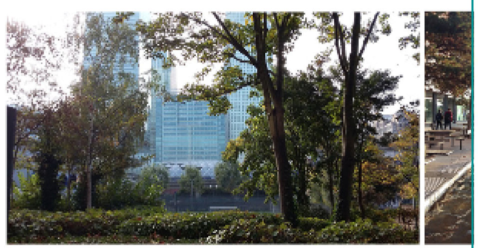


Figure #8-1: Examples of local blue / green infrastructure: (left) Local park in Popla
and water features, Birmingham

Scoring this question

One mitigation point should be allocated if at least 50%
radius of the buildings are to be blue/green.

Areas of green roofs or living walls could be used to co

This point can more easily be awarded in a rural contex
although as this considers the very local neighbourhoo
developments with large hard-surfaced areas and little

Figure #8-2: Examples of using satellite view (google) to help score this question: these two sites in East London have similar built typologies with mostly low-rise housing and some isolated high-rise blocks, and would score the same for overall urban heat island effect (#2) because of their location in Tower Hamlets and Hackney. However, at the local scale (100m radius) they have very different characteristics in terms of green infrastructure, with the left-hand side site likely to experience higher local temperatures.

Mitigation

Seek to incorporate blue and green infrastructure to increase the proportion in the neighbourhood; more locally this may have added benefits to the scheme itself by offering local shading and cooling effects as well as other biodiversity, health and wellbeing benefits.

References

Evidence and background information: http://www.zerocarbonhub.org/sites/default/files/resources/reports/ZCH-OverheatingEvidenceReview.pdf, p14 onwards 'Addressing the Urban Heat Island – Trees and green space'

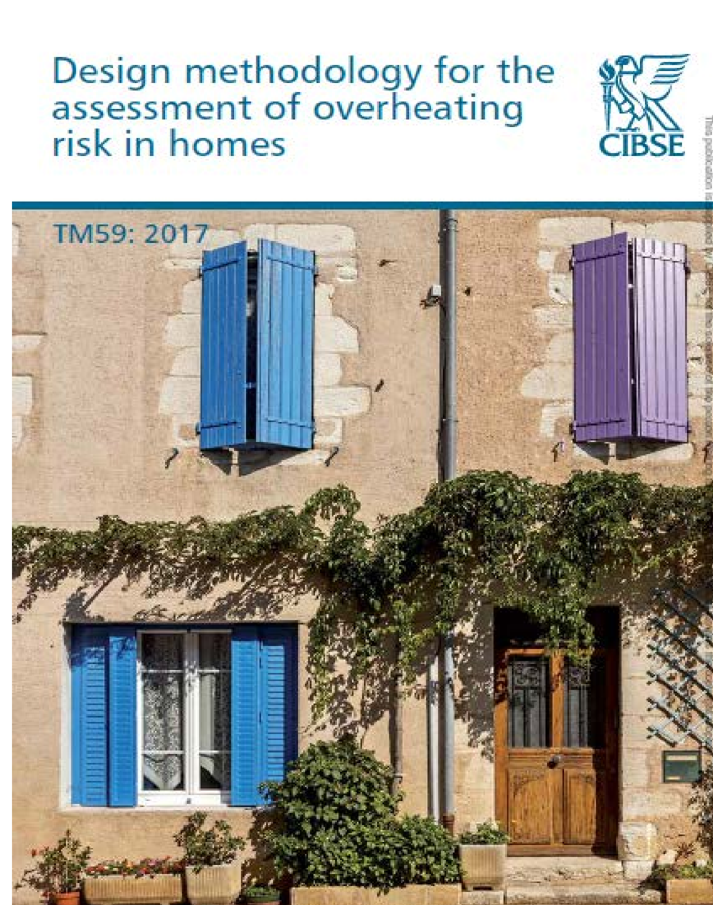
Blue/green infrastructure mapping of Greater London: https://maps.london.gov.uk/green-infrastructure/; in the future this may be linked to quantified data, for example by reference to the Urban Green Factor proposed in the raft London Plan (policy G5 - https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-new-london-plan/chapter-8-green-infrastructure-and-natural-environment/policy-g5)

Blue/green infrastructure mapping of Birmingham: Birmingham Green Living Spaces Plan - https://www.birmingham.gov.uk/download/downloads/id/832/green_living_spaces_plan.pdf, see Green & Blue Infrastructure map on Plan 7

Blue /green infrastructure mapping of Liverpool: The Value of Mapping Green Infrastructure, RICS, 2011 - https://www.merseyforest.org.uk/files/The_Value_of_Mapping_Green_Infrastructure_pdf.pdf

TM59

- Launched in June 2017
- Prescriptive methodology
- Focuses on naturally ventilated (free running) homes
- Two Criteria:
  1. adaptive thermal comfort tested in all rooms
  2. additional night time hours of exceedance test for bedrooms



TM59 - Presenting results

Example results

Zone Name	Room Use	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Annual Night Occupied Hours for Bedroom	Max Exceedable Night Hours	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result
A3_Bed1	Bedroom	3672	110	34	3285	32	27	Pass
A3_Bed2	Bedroom	3672	110	34	3285	32	28	Pass
A3_Kitchen/Living	Living Room / Kitchen	1989	59	71	N/A	N/A	N/A	Fail
A4_Bed1	Bedroom	3672	110	44	3285	32	38	Fail
A4_Bed2	Bedroom	3672	110	41	3285	32	38	Fail
A4_Kitchen/Living	Living Room / Kitchen	1989	59	167	N/A	N/A	N/A	Fail
B21_Bed1	Bedroom	3672	110	78	3285	32	26	Pass
B21_Kitchen	Living Room / Kitchen	1989	59	40	N/A	N/A	N/A	Pass
B21_Living	Living Room / Kitchen	1989	59	149	N/A	N/A	N/A	Fail
B22_Bed1	Bedroom	3672	110	45	3285	32	37	Fail
B22_Bed2	Bedroom	3672	110	68	3285	32	38	Fail
B22_Bed3_single	Bedroom	3672	110	72	3285	32	32	Pass
B22_Kitchen/Living	Living Room / Kitchen	1989	59	80	N/A	N/A	N/A	Fail

Reducing Overheating Risk

- Windows are the key

Barriers to windows opening

- **Noise**
- Security
- Health and safety
- Air quality

How does AVOG help?

- When is it too noisy to rely on opening windows?
- Is that on all facades?
- Is that at all times of day and night?
- What if windows were only partially open?
- Define partially open
- Are there passive measures that would help?

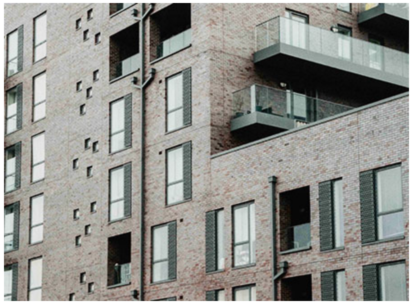
Removing the option to rely on opening windows to reduce overheating has huge implications

Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources [Note 1] relating to overheating condition

Risk category for Level 1 assessment [Note 5]			Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,T}$ [Note 3] during 07:00 - 23:00		$L_{Aeq,8hr}$ during 23:00 - 07:00		
	High		Increasing risk of adverse effect	Recommended
65 dB		55 dB		
60 dB	Medium			
55 dB	Low	50 dB		Optional
50 dB	Negligible	45 dB	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

Key mitigations

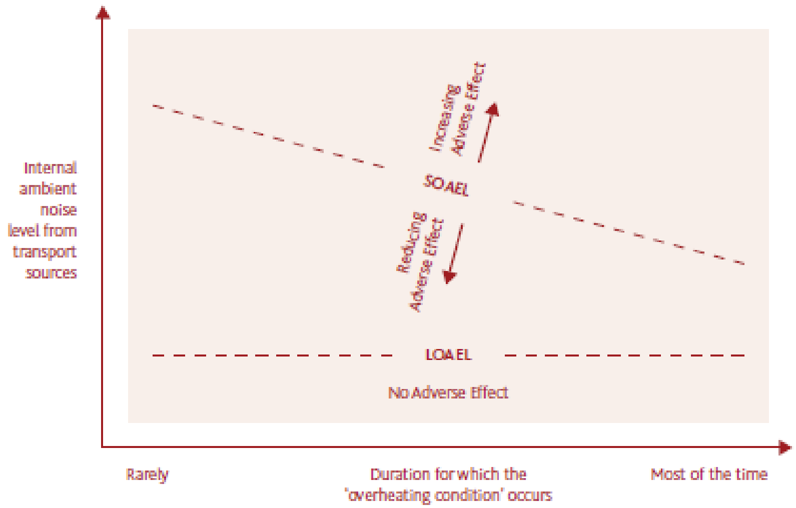
- Noise:
  - Design apartments with dual aspect and locate bedrooms away from noisy facades
  - Acoustic barriers around site (trees, fences etc)
  - Utilising balconies – solid balustrades and noise absorbing materials
  - Acoustic vents and ceiling fans
  - MVHR rarely sufficient for overheating purge
  - Mechanical cooling BUT
    - Can make microclimate worse for neighbours
    - Potential for coolth poverty



Investigating cases of overheating

- What is the temperature within the dwelling?
  - Max and min – diurnal variation
  - Duration – normally 3 week sample
- What are the sources of heat?
  - How does that square with the ERs, etc?
- What were the design means of heat rejection?
  - Are they effective?
  - Are they reasonable?
- HHSRS / Homes (Fitness for Human Habitation) Act 2018

Figure 3-2 Qualitative guidance on combined effect of internal ambient noise level and duration for the overheating situation



Reducing Overheating AND Noise risks

Acousticians and overheating risk analysists need to:

- Read and understand each others reports
- Support and respect each others findings
- Have a conversation about the relative risks and potential mitigation measures
- Define thresholds at which either risk becomes unacceptable

The bottom line is ensuring occupants are safe and comfortable in their own homes. It’s challenging.. but

The End

INKLING

Thank you for listening!

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